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PERMANENTLY CLOSED ENCLOSURE APPARATUS AND METHOD FOR ACCESSING AN INTERNAL PORTION THEREOF

5 BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to enclosures and more particularly to permanently closed enclosure apparatus and methods for accessing an internal portion thereof.

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2. Description of Related Art

Two-piece housings for enclosing electronics or other components are often designed in a manner that makes it easy to attach the two pieces, while at the same time ensuring that the two pieces are securely held to each other. Various methods using screws or pins have been developed to lock the two pieces together. However, often additional pieces or tools are required, which can complicate use of the enclosure, especially in applications where ease of fastening is desired. Snap together housings are available, but usually the two pieces of the housing cannot be separated from each other without physically damaging the mating pieces, rendering both pieces unusable.

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SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, there is provided an enclosure apparatus comprising a first enclosure portion and a second enclosure portion configured to mate with the first enclosure portion. A receptacle is provided on the first enclosure portion. The receptacle has a frangible wall portion accessible from an exterior of the first enclosure portion. The frangible wall portion is operable to be broken from outside the enclosure apparatus. A protrusion is provided on the second enclosure portion and the protrusion is operable to be received in the receptacle. A first locking member is connected to the frangible wall portion to extend inside the receptacle and a second locking member is provided on the protrusion. The second locking member is

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configured to engage the first locking member such that separation of the first and second enclosure portions is prevented unless the frangible wall portion is deliberately broken.

5 The receptacle may include first and second guides on opposite sides of the first locking member.

10 The protrusion may include first and second rails disposed on opposite sides of the second locking member, the first and second rails being operable to be received in the first and second guides respectively.

15 The first and second guides and the first and second rails may be dimensioned such that the first and second rails are snugly received in the first and second guides respectively.

20 The first locking member may include a first projection extending substantially parallel to a direction of relative movement of the first and second enclosure portions when the protrusion is being received in the receptacle.

25 The second locking member may include a second projection extending generally parallel to a direction of relative movement of the first and second enclosure portions when the protrusion is being received in the receptacle.

30 The first projection may have a first abutting surface and the second projection may have a second abutting surface, the first and second abutting surfaces interfering with each other when the projection is received in the receptacle, to prevent separation of the first and second enclosure portions.

35 The first projection may be resiliently deformable.

40 The second projection has a camming surface operable to deform the first projection from a rest position while the protrusion is being inserted into the

receptacle. The first projection may resiliently return substantially to its rest position when the protrusion is fully received in the receptacle. The first abutting surface of the first projection interferes with the second abutting surface of the second projection when the first projection is substantially in its rest position.

The first and second abutting surfaces may be shaped to maintain the first projection substantially in its rest position in response to relative movement of the first and second enclosure portions attempting to separate the first and second enclosure portions.

The first and second abutting surfaces may be complementarily angled.

The first projection may have a distal end portion and the first abutting surface may be on the distal end portion. The second enclosure portion may have a locking wall portion that is positioned immediately adjacent the distal end portion when the protrusion is fully received in the receptacle, such that the distal end portion is trapped between the second abutting surface and the locking wall portion.

The apparatus may further include a movement preventer configured to prevent movement between the first and second enclosure portions when the protrusion is fully received in the receptacle.

The movement preventer may include complementary engaging components on the first and second enclosure portions respectively operable to snugly engage with each other.

The complementary engaging components may include a post on the first enclosure portion and a wall defining an opening on the second enclosure portion, the post being receivable in the opening.

The post and the wall defining the opening may be complementarily tapered to provide a snug fit therebetween.

5 The receptacle may have an adjacent wall portion adjacent the frangible wall portion and the adjacent wall portion and the frangible wall portion may be dimensioned such that the frangible wall portion is thinner than the adjacent wall portion.

10 The frangible wall portion may include an opening to facilitate breaking the frangible wall portion.

The frangible wall portion may include first and second openings on opposite sides of the first locking member to facilitate breaking the frangible wall portion.

15 The first enclosure portion may be formed from a plastic material.

20 In accordance with another aspect of the invention, there is provided a method of securing a location monitoring device to a live animal. The method involves engaging first and second mating enclosure portions with each other to enclose a monitoring circuit therewithin, such that a protrusion on the second enclosure portion is received in a receptacle on the first enclosure portion to engage a first locking member on an exteriorly accessible frangible portion of a wall of the receptacle with a second locking member on the
25 second enclosure portion such that the first and second locking members cooperate to prevent separation of the first and second enclosure portions unless the frangible wall portion is deliberately broken.

30 In accordance with another aspect of the invention, there is provided a method of accessing an internal portion of an enclosure comprising first and second enclosure portions. The method involves breaking a frangible portion of a wall of a receptacle to which a first locking member on the first enclosure

portion engaged with a second locking member on the second enclosure is attached, to permit first and second abutting surfaces of the first and second locking members respectively to be separated from interfering engagement, thereby permitting the first and second enclosure portions to be separated from each other.

Breaking the frangible portion may include inserting a tool in at least one opening in the frangible portion.

The present invention facilitates easily snapping together two mating pieces without using any additional parts or tools, other than the mating pieces themselves. This is especially desirable in scenarios where it is necessary to prevent tampering of the contents of the housing, or to cause irreversible damage to the housing providing irrefutable evidence of tampering, if tampering does take place. The two mating pieces can be legitimately separated in a way that only one mating piece is damaged, without any damage to the other mating piece or the contents of the housing. Thus, the undamaged mating piece and the contents of the housing can be re-used, if desired.

One particular application of this type of locking mechanism is in the design of the housing assembly for a tagging or monitoring device that may be strapped on an ankle or wrist of an individual to be monitored, such as an offender.

Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention,

5 Figure 1 is an oblique view of an enclosure apparatus according to a first embodiment of the invention;

 Figure 2 is an oblique view of a first enclosure portion of the apparatus shown in Figure 1;

10 Figure 3 is an oblique view of a second enclosure portion of the apparatus shown in Figure 1;

 Figure 4 is a cross-sectional view of the apparatus shown in Figure 1 taken along lines 4-4;

15 Figure 5 is a section view of an alternative embodiment of the apparatus as would be seen if taken along lines 4-4 in Figure 1;

20 Figure 6 is a schematic representation of the installation of the enclosure apparatus of Figure 1 on a human.

DETAILED DESCRIPTION

25 Referring to Figure 1, an enclosure apparatus according to a first embodiment of the invention is shown generally at 10. The apparatus includes a first enclosure portion 12, and a second enclosure portion 14 configured to mate with each other to form an enclosure. In the embodiment shown, the first and second enclosure portions are formed from a plastic material. A payload, such as a circuit board, for example, may be secured to either enclosure portion 12 or 14, for example.

30 Referring to Figure 2, in the embodiment shown, the first enclosure portion 12 has first and second opposite ends shown generally at 16 and 18 on which

are formed first and second receptacles shown generally at **20** and **22** respectively.

Referring to Figure 3, the second enclosure portion **14** has first and second opposite ends shown generally at **24** and **26** on which are formed first and second protrusions shown generally at **28** and **30** respectively. The first and second protrusions **28** and **30** are received in the first and second receptacles **20** and **22** respectively when the first and second enclosure portions **12** and **14** are in mating engagement.

Referring back to Figure 2, the first and second receptacles **20** and **22** are similar. The view shown in Figure 2 provides an inside view of the first receptacle **20** and an outside view of the second receptacle **22**. The first and second receptacles **20** and **22** are similar. The receptacles **20** and **22** each include a locking member **60** and first and second guides **32** and **34** formed on opposite sides of the locking member. In this embodiment, the first and second guides **32** and **34** extend above the nominal height of the first enclosure portion. The first and second guides **32** and **34** each include an inner wall **36** generally parallel to the end of the first enclosure portion **12**, an outwardly projecting wall **38** extending at right angles to the inner wall **36** and an external wall **40** extending between the outwardly projecting walls **38**, parallel to the inner walls **36** and spaced apart therefrom. An inner, upstanding wall **41** extends parallel to, between and adjacent to the inner walls **36** of the first and second guides **32** and **34** and a lower wall portion **45** seen best in Figure 4, extends between the upstanding wall **41** and the external wall **40** to prevent access to the space formed therebetween.

The external wall **40** has frangible wall portions **42** and adjacent wall portions **44** extending about the frangible wall portions. The adjacent wall portions **44** and the frangible wall portions **42** are dimensioned such that the frangible wall portions are thinner than the adjacent wall portions.

In the embodiment shown, the frangible wall portions **42** are formed by first and second spaced apart recesses **46** and **48** extending from an edge **50** of the external wall **40** part way into the external wall. A bridge portion **52** is formed between the first and second recesses **46** and **48**. The external wall **40** may be about $1/8$ inches in thickness and the frangible wall portions **42** may be about $1/16$ inches in thickness, for example. The bridge portion **52** may be about $1/4$ inches in width, for example.

In the embodiment shown the frangible wall portions **42** have respective openings **54** and **56** therein that are sized to permit respective jaws of diagonal cutters, for example to be received therein to permit the bridge portion **52** to be cut, enabling the frangible wall portion **42** to be relatively easily broken as will be explained more fully below.

A first locking member shown generally at **60** is secured to the frangible wall portions **42** by tabs, only one of which is shown at **62**. The tabs may be ultrasonically welded, for example, to the frangible wall portions **42**, or may be formed therein at a location between the openings **54** and **56** and the edge **50**. The tabs **62** are connected to a support member **64** of the first locking member **60**. The support member **64** projects inwardly of the first enclosure portion **12** into an area between the first and second guides **32** and **34**. The first locking member **60** further includes a first projection **66** extending parallel to a direction of relative movement of the first and second enclosure portions **12** and **14** when the first and second enclosure portions are brought together into mating engagement. The first projection **66** has an enlarged free distal end portion shown generally at **68**, having a outwardly angled surface **70** and a first abutting surface **72** extending generally at right angles to the direction in which the first locking member **60** extends, although as will be appreciated below, this first abutting surface **72** may also be slightly angled. In this embodiment, the first abutting surface **72** is spaced apart from a top surface **43** of the upstanding wall **41**.

The apparatus further includes a movement preventer shown generally at **73** in Figure 1. The movement preventer **73** is configured to prevent movement between the first and second enclosure portions **12** and **14**. Referring to Figure 2, in this embodiment, the movement preventer **73** includes first and second cylindrical posts **75** and **77** on respective support members **64** of the first locking members **60**.

Referring to Figure 3, as stated above, the first and second protrusions **28** and **30** are received in the first and second receptacles **20** and **22** (Figure 2) respectively, when the enclosure portions are brought together. The first and second protrusions **28** and **30** are the same and therefore only one will be described.

The second protrusion **30** is seen best in Figure 3 and protrudes beyond a nominal edge **81** of the second enclosure portion **14**. The second protrusion **30** includes first and second spaced apart rails **80** and **82** and a second locking member **84** disposed between the first and second rails. The second locking member **84** includes a second projection **86** and the first and second rails **80** and **82** and the second projection **86** extend parallel to the direction of relative movement of the first and second enclosure portions **12** and **14** when the first and second protrusions **28** and **30** are being received in the first and second receptacles **20** and **22** (Figure 2), respectively.

The first and second rails **80** and **82** are positioned on the second enclosure portion **14** and are dimensioned such that they are snugly received in corresponding first and second guides (**32** and **34** in Figure 2) of the first enclosure portion (**12** in Figure 2). For this purpose, the first and second rails **80** and **82** may have distal, slightly tapered portions **88** and **90** respectively. In general, the rails are made relatively large, for strength.

The second projection **86** has an outer edge **92** forming a distal end **93** thereof and a second abutting surface **94** that are spaced apart and face

away from each other in opposite directions. The second projection **86** is tapered outwardly such that it is thinner at the outer edge **92** and thicker at the second abutting surface **94**. The second projection **86** has a camming surface **87** that defines the taper between the distal end **93** and the second abutting surface **94**. The second locking member **84** further has a locking wall portion **96** immediately adjacent to and extending generally at right angles to the second abutting surface **94** and parallel to the end of the second enclosure portion **14**.

The second enclosure portion **14** further includes first and second cover portions **95** and **97** that depend from respective ends **24** and **26** of the second enclosure portion **14** and which extend between the first and second rails **80** and **82** and over the locking wall portion **96** and second locking member **84**. The first and second cover portions **95** and **97** have respective openings **99** and **101** operable to receive the posts **75** and **77** shown in Figure 2 on the first enclosure portion **12**, respectively. The posts **75** and **77** and openings **99** and **101** are dimensioned such that the posts are snugly received in the openings, and thus the posts and openings cooperate to prevent relative movement between the first and second enclosure portions **12** and **14**.

Referring to Figure 4, when the first and second enclosure portions **12** and **14** are fully engaged, the first and second locking members **60** and **84** are engaged such that the first and second abutting surfaces **72** and **94** interfere with each other to prevent separation of the first and second enclosure portions **12** and **14**.

To achieve engagement of the first and second locking members **60** and **84**, the first and second enclosure portions **12** and **14** are positioned such that at each end of the enclosure portions the distal end **93** of the second locking member **84** is positioned between the distal end portion **68** of the first locking member **60** and the upstanding wall **41**, as shown in broken outline in Figure 4. Then, the first and second enclosure portions **12** and **14** are pushed

together in the directions indicated by arrows **102** and **104**. Pushing the first and second enclosure portions **12** and **14** together causes the camming surface **87** of the second projection **86** to bear upon the distal end portion **68** of the first projection, causing the first projection to deform outwardly from its rest position, toward the external wall **40** as shown in broken outline at **106**, while the camming surface **87** is in contact therewith. The thickness of the support member **64** may determine the amount of additional force required to deform the first projection **66**. Desirably, the support member **64** is dimensioned such that a moderate amount of force is required to deform the first projection **66** before the first and second enclosure portions **12** and **14** are fully engaged. When the second projection **86** is fully received in the receptacle **22**, as shown in solid outline in Figure 4, the camming surface **87** no longer bears upon the distal end portion **68** and the first projection **66** is allowed to resiliently return to its rest position shown in solid outline. In this position, the first and second abutting surfaces **72** and **94** abut each other and interfere with each other to prevent separation of the first and second enclosure portions **12** and **14**. No access is provided to the first and second locking members **60** and **84** on either end of the enclosure apparatus so formed and therefore they cannot be disengaged.

The first and second abutting surfaces **72** and **94** are shaped to maintain the first projection **66** substantially in its rest position shown in solid outline even in response to relative movement of the first and second enclosure portions **12** and **14** attempting to separate them. In the embodiment shown, this may be achieved by forming the first and second abutting surfaces **72** and **94** such that they extend at right angles to the direction of movement required to separate the first and second enclosure portions **12** and **14**. Alternatively the first and second abutting surfaces **72** and **94** may be slightly angled as shown at **83** and **85** in Figure 5 such that opposing forces on the first and second enclosure portions **12** and **14** tending to separate the enclosure portions cause the first locking member **60** to be deflected toward the adjacent locking wall portion **96** which also prevents separation of the first and second

enclosure portions **12** and **14**. Effectively, the distal end portion **68** of the first projection **66** is trapped between the second abutting surface **94** and the adjacent locking wall portion **96**.

5 Also when the first and second enclosure portions **12** and **14** are fully engaged, the posts **75** and **77** are fully received in respective openings **99** and **101** which further prevents relative movement between the first and second enclosure portions **12** and **14**. Lateral movement is especially prevented. It will be appreciated that in general, the posts **75** and **77** are
10 shaped complementarily to the openings **99** and **101** in which they are received. While, the posts **75** and **77** and openings **99** and **101** have been shown as being circular cylindrical, the posts and openings may be rectangular or any other shape and/or may be tapered to form a wedge-fit therebetween.

15 In order to separate the first and second enclosure portions **12** and **14** to access an internal portion of the enclosure, it is necessary to deliberately break the frangible wall portions **42** on each end of the first enclosure portion **12**, thereby damaging the first enclosure portion. Breaking the frangible wall
20 portions **42** may be achieved by inserting the jaws of a pair of diagonal cutters, for example, into respective openings **54** and **56** and cutting through the bridge portion **52**. The frangible wall portions **42** may then be pried away from the surrounding adjacent wall portions **44**, leaving the first locking member **60** loose in the space defined by the bottom surface **98** of the top
25 cover portion, the locking wall portion **96**, the second abutting surface **94** and the exterior wall **40**. With the first locking member **60** no longer connected to the exterior wall **40**, the first and second abutting surfaces **72** and **94** of the first and second locking members **60** and **84** respectively may be separated from interfering engagement, thereby permitting the first and second
30 enclosure portions **12** and **14** to be separated from each other.

The first and second enclosure portions **12** and **14** may be separated relatively easily, by pulling them apart in directions opposite to the directions shown by arrows **102** and **104**, respectively.

5 Since the frangible wall portions are broken to facilitate separation of the first and second enclosure portions **12** and **14**, the damaged exterior walls **40** provide evidence of tampering with the enclosure.

10 One particular application of the enclosure described herein is in securing a location monitoring device to a live animal or human. The location monitoring device may be a device used by corrections authorities to ensure an offender is confined to a certain area such as a home, for example. Referring to Figure **6**, the first enclosure portion **12** may be secured to the offender's leg **108** by non-removable straps **110** and **112**. Then the first and second mating enclosure portions **12** and **14** may be engaged with each other to enclose a monitoring circuit therewithin. Referring to Figure **4**, as the first and second enclosure portions **12** and **14** are engaged, the protrusions **28** and **30** on the second enclosure portion **14** are fully received in corresponding receptacles **20** and **22** on the first enclosure portion **12** to engage the first locking member **60**, on the exteriorly accessible frangible wall portions **42** of the receptacles, with the second locking member **84** on the second enclosure portion **14** such that the first and second locking members cooperate to prevent separation of the first and second enclosure portions unless the frangible wall portions **42** are deliberately broken. Should the offender tamper with the enclosure, the only way to get into the enclosure is to break the frangible wall portions **42**, which causes irreversible damage to the first enclosure portion **12**, enabling enforcement authorities to see that tampering has occurred.

30 The present invention provides a permanently closed enclosure that when opened, leaves at least one component, namely the first enclosure portion **12** permanently damaged. However, only the first enclosure portion **12** is damaged. The second enclosure portion **14** may be reusable and thus costs

for using such enclosures are reduced, because only one portion of the enclosure need be replaced.

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While specific embodiments of the invention have been described and illustrated, such embodiments should be considered illustrative of the invention only and not as limiting the invention as construed in accordance with the accompanying claims.
